PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
INT04148N		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NO2004/000311	14-10-2004	30-10-2003
International Patent Classification (IPC) or national classification and IPC		
See Supplemental Box		
Applicant		
STATOIL ASA ET AL		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 5 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))
      _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
01-04-2005	26-01-2006
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Anna Lundqvist/MN Telephone No. +46 8 782 25 00

Form PCT/IPEA/409 (cover sheet) (April 2005)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Cover sheet

INTERNATIONAL PATENT CLASSIFICATION (IPC):

G01B 17/02 (2006.01)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/NO2004/000311

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☐ the international application in the language in which it was filed

☐ a translation of the international application into _____ ,
which is the language of a translation furnished for the purposes of:

☐ international search (Rules 12.3(a) and 23.1(b))

☐ publication of the international application (Rule 12.4(a))

☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-14 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 1-5 received by this Authority on 27-12-2005

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-3 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/NO2004/000311

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-22	YES
	Claims		NO
Inventive step (IS)	Claims	1-22	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-22	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The application refers to an arrangement for the investigating the wall thickness of a tube, transporting fluid, by ultrasonic transducers arranged as a band.

Reference is made to the following documents:
D1: US 4641531 A1
D2: US 4160386 A1

Document D1 refers to an ultrasonic inspection apparatus and method for locating multiple defects in, and the thickness of eccentric wall tubular goods. The tubes can contain fluids. The ultrasonic transducers are situated in an array formation on the outside of the tube. See for instance the abstract, column 3, lines 59-61, column 4, lines 7-10 and figure 8.

Document D2 refers to an ultrasonic inspection system. The apparatus inspects the walls of a pipe and the seam weld or butt weld. See for instance the abstract, column 1, lines 22-26, column 4, lines 26-29 and figures 1 and 2.

The technique mentioned in the independent claims 1, 18, 19 and 22 differs from what is described in document D1 in that the ultrasonic transducers are positioned as a part of a tape. This improves and simplifies the attachment of a condition control means to a pipeline. Also, the transducers are connected to a multiplexer, providing a common electrical connection for all the transducers between the tape and its surroundings, which is not the case for the technique in D1. Claim 18 describes a feature of embedding the ultrasonic transducers in a coating made of a polymeric material, for

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

protection. This is not mentioned in D1 or D2.

Accordingly, the invention defined in claims 1-22 is novel and is considered to involve an inventive step. The invention is industrially applicable.

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27 -12- 2005

C l a i m s

1. Means for condition control of a pipeline (1) incorporating a fluid flow pipe (15) for transport of a fluid, comprising a plurality of ultrasonic transducers (3_1-3_N) arranged in the vicinity of the external surface (100) of the pipe (15), and wherein a characterization of the pipeline (1), for example a measurement of the wall thickness, may be performed based on emission, receipt and analysis of the ultrasonic signals (3_1-3_N), c h a r a c t e r i z e d i n that the ultrasonic transducers (3_1-3_N) are positioned as a part of at least one tape (2), the tape (2) being provided with a channel multiplexer (11) electrically connected to several of the transducers (3_1-3_N) by means of conducting tracks (9) on the tape (2), and wherein the channel multiplexer (11) provides a common electrical connection for said several transducers (3_1-3_N) between the tape (2) and its surroundings.

2. Means for condition control according to claim 1, wherein the transducers (3_1-3_N) are arranged in an array pattern (4).

3. Means for condition control according to claim 1, wherein the at least one tape (2) is attached on to the external surface (100) of the pipe (15) by means of a clamping or an attachment device (5).

4. Means according to claim 3, comprising a protective coating (7) for thermal and mechanical protection, the protective coating (7) arranged on the external surface (100) of the pipe (15) also functioning as a clamping or an attachment mean (5) or part of a clamping or an attachment means (5) for the tape (2).

5. Means according to claim 1, wherein the tape (2)

comprises electrical elements, such as for example electrical/electronic components (8) and conducting tracks (9).

6. Means according to claim 1, wherein the tape (2) comprises a protective layer (13), for example a layer of silicon rubber, for thermal and mechanical protection.

7. Means according to claim 3, comprising a multiplexer (11) for multiplexing signals from the various transducers (3_1-3_N).

8. Means according to claim 3, comprising a digital thermometer (12) for measuring the temperature, allowing characterizing to be performed with temperature compensation.

9. Means according to claim 3, comprising a plurality of tapes connected together in order to cover a larger part of the circumference of the pipe (15).

10. Means according to claim 1, wherein the tapes (2) cover a critical segment of the pipe (15) circumference.

11. Means according to claim 1 or 2, wherein the transducers (3_1-3_N) are covered by an external protective coating (7) for corrosion protection or insulation.

12. Means according to claim 1, wherein the ultrasonic transducers (3_1-3_N) are connected to an electrical contact mean (30) in order to provide a possibility of connection with external equipment (200,300).

13. Means according to claim 12, wherein the contact means (30) are placed on the external surface of the protective coating (7), whereby the contact means (30) may be accessible by removal of a part of the protective

coating (7) surrounding the contact means.

14. Means according to claim 12, wherein the contact means (30) comprises an electrical cable extending out through the protective coating (7).

15. Means according to claim 12, wherein the contact means (30) comprises an protruding electrical cable terminated close to the external surface of the protective coating (30).

16. Means according to claim 14 or 15, wherein the cable is terminated in a subsea contact.

17. Means according to claim 1, comprising at least two tapes (2) for transducers, the first tape (2A) being arranged on one side of a weld or joint (20) and a second tape (28) being arranged on the other side of said weld or joint (20).

18. Means for condition control of a pipeline (1) with a fluid flow pipe (15) for transport of a fluid, comprising a plurality of ultrasonic transducers which are embedded in and protected by a surrounding polymer material, the polymer material functioning as protection of the exterior surface (100) of the pipe (15), and wherein emission, receipt and analysis of ultrasonic signals by means of transducers (3_1-3_N) are used for characterization of the pipeline, for example a measurement of the thickness of the pipeline,
c h a r a c t e r i z e d i n t h a t the ultrasonic transducers (3_1-3_N) are arranged as an integral part of at least one tape (2) and that the ultrasonic transducers (3_1-3_N) are connected to an external drive, control and signal analysis unit by means of an inductive connection means, and wherein the ultrasonic transducers (3_1-3_N) are embedded in and protected by a surrounding polymeric material, the

polymeric material functioning as a protection of the exterior (100) of the pipe (15).

19. System for condition control of a pipeline for transport of a fluid, comprising an ultrasonic apparatus for generation of drive signals for a plurality of ultrasonic transducers emitting ultrasound, an A/D converter which also is connected to the ultrasonic transducers for converting analog signals from the ultrasonic transducers to digital data corresponding to the analog signals from the ultrasonic transducers and transmitting the digital data to a control and data analysis unit, analyzing the received signals, c h a r a c t e r i z e d i n t h a t a plurality of ultrasonic transducers are arranged as an integral part of one or more tapes, the tapes being permanently attached to the external surface of the pipeline wall and ply to the pipeline surface when clamped, the ultrasonic transducers (3_1-3_N) being embedded in and protected by a surrounding polymeric material, the polymeric material functioning as a protection for the external surface (100) of the pipe (15), the properties of the pipeline, such as for example possible reduction of pipeline thickness or properties at a weld or a joint, being calculated by means of the digital data and a software module for thickness calculation as a part of the data analysis unit.

20. System according to claim 19, wherein the software module for thickness calculations comprises software for an identification of the reflected acoustic signals in the digital data and calculating the time delay between emitted and reflected acoustic signals.

21. System according to claim 20, wherein the software module for thickness calculations comprises software for identification of the reflected acoustic signals in the digital data and for analyzing the amplitudes of the

reflected acoustic signals.

22. Means for condition control of a pipeline (1) incorporating a fluid flow pipe (15) for transport of a fluid, comprising a plurality of ultrasonic transducers (3_1-3_N) arranged in the vicinity of the external surface (100) of the pipe (15), and wherein a characterization of the pipeline (1), for example a measurement of the wall thickness, may be performed based on emission, receipt and analysis of the ultrasonic signals by means of ultrasonic transducers (3_1-3_N),
c h a r a c t e r i z e d i n t h a t the ultrasonic transducers (3_1-3_N) are positioned as a part of at least one tape (2), the tape being embedded in and protected by a surrounding polymeric material, the polymeric material functioning as protection of the external surface (100) of the pipeline (15).